PATIENT POSITIONING DEVICE FOR A COMPUTER TOMOGRAPH

[0001] The invention relates to a patient positioning device for a computer tomograph device.

[0002] A computer tomograph device or CT device for short, serve to make three-dimensional images or images of slices of a body. The image data are computed by a computer using two-dimensional X-ray projections of the body. For recording the two-dimensional raw image data, an X-ray beam source and an image detector are disposed diametrically opposite one another and rotate about the body. The rotation takes place inside a gantry which has an examination opening,, into which the body can be introduced.

[0003] The position of the body in the gantry and the stability of its position there are decisive for the image quality. A patient positioning device must therefore assure sufficiently stable support of the patient's body and should not have any significant sagging, for instance, in response to the patient's weight. At the same time, though, a complicated construction for supporting the patient's body in the examination opening of the gantry cannot be used, because it would create interfering artifacts in the image there.

[0004] On the other hand, a patient positioning device should be adjustable flexibly enough that handling the patient when shifting himpatient onto the patient positioning device and providing medical care of a patient already lying on it is made simpler. For example, it may be desirable for the patient positioning device to be able to be lowered so the patient can lie down on it and raised so the patient can get up from it.

[0005] Ggood accessibility for medical staff is advantageous, and for that reason the space below the patient positioning device should as much as possible be free and without intervening constructions.

[0006] From German patent disclosure DE 101 08 549, a patient positioning device is known that enables flexible positioning and assures a stable position of

the patient's body in the examination opening of the gantry of a CT device. However, it offers no possibility of height adjustment, and below the patient lying on it, it has a bulky construction, which makes accessibility more difficult.

[0007] The object of the invention is to disclose a patient positioning device for a computer tomograph (CT) device which ensures a stable position of the patient body in the examination opening of the gantry, is simultaneously flexibly adjustable in position, and has good accessibility to medical staff.

[0008] This object is attained by a patient positioning device having the characteristics of the independent claim.

[0009] patient positioning device for a computer tomograph device which device includess a gantry supported on a base; the patient positioning device includes a bed guide for a patient bed; and has an arm which is supported on or at the base by a rotating joint that is rotatable about a horizontal axis, that is rotatable about a horizontal axis , and the bed guide is supported on the arm by a rotating joint that is rotatable about a horizontal axis, and the height of the bed guide is adjustable.

[0010] Because of the support of the bed guide on an arm that extends from the base of the CT device, a construction is obtained in which the space below the bed guide remains free.

[0011] This assures good accessibility to the patient. The term bed guide should be understood in this context to mean a structural element that makes it possible to attach a patient bed. The bed guide may have the capability of being solidly connected to a patient bed, or it may be embodied as a rail-like guide that allows the patient bed to be placed on edit or inserted and that guides the patient bed displaceably in the longitudinal direction

[0012] The motion of the patient bed that results from the rotatable mounting of the arm on the base of the gantry has the further advantage that the patient bed, on being lowered so a patient can be placed on it, is simultaneously moved the bed away from a gantry . Because of the greater distance from the gantry, the accessibility of the patient bed is improved and, furthermore there is less interference with any operation of the gantry that may be taking place at the same

time. Thus a CT examination can for instance proceed unimpeded while another patient is being placed on the lowered patient bed.

[0013] While being raised, the bed guide is also simultaneously moved closer to the gantry, which is an improvement in terms of wear and tear on the patient bed and thus on the patient's body in the examination area. For instance, the leverage with which the patient weight is supported relative to the bed guide and which causes sagging of the patient bed is reduceds.

[0014] In an advantageous embodiment of the invention,, the patient positioning device has a height adjuster, which is connected to the arm such that it can rotate the arm about the rotating joint by which the arm is supported on or at the base. The height adjuster has a motor for this purpose, which adjusts the arm, for instance, by means of a worm drive associated with the motor and a gear wheel on the arm. The motor may also drive hydraulic drive that drives the arm around the rotating joint. The height adjuster assures an automatic adjustment of the height of the patient bed and thus makes the work of the medical staff easier.

[0015] In a further advantageous embodiment, the patient positioning device has a support arm, which is supported on the arm by a rotating joint that is rotatable about a horizontal axis, and on which support arm the bed guide is supported by a rotating joint that is rotatable about a horizontal axis, and its length is be automatically adjustable such that the orientation of the bed guide remains stable, regardless of a rotation of the arm. This assures that a patient can be placed for instance on the horizontally oriented patient bed, and that thisorientation is maintained when the height of the patient bed is adjusted.

[0016] Maintaining the orientation is on the one hand pleasant for the patient who is being moved automatically by the patient positioning device, On the other, it enables positioning the patient, with the patient bed lowered, in exactly the position in which an ensuing CT examination is to be done. Changes in the patient position, as the patient positioning device is moved to approach the gantry, which could cause movements on the part of the patient and hence interfering artifacts from that motion in the CT image data, are thus averted.

[0017] The automatic adjustment of the length of the support arm can be implemented by the same principle as the rotary motion of the arm. For instance, if the rotary motion is attained purely mechanically, such as by a worm drive and a gear wheel, then the length of the support arm can also be accomplished by means of a mechanical gear-wheel or lever system. If the rotary motion of the arm is conversely driven hydraulically, then the length of the support arm can also be adjusted hydraulically.

[0018] The hydraulic adjustment enables especially flexible movement of both the arm and the support arm, so that the height of the patient bed is adjustable via the arm, and its orientation is adjustable via the support arm, freely and independently of one another. If the orientation of the bed guide is to be maintained while the arm is being adjusted, the longitudinal adjustment of the support arm may be adapted to the motion of the arm. To that end, the hydraulic drive can perform the longitudinal adjustment in accordance with a characteristic curve as a function of the adjustment of the arm. The characteristic curve depends on the geometric relationships among the arm, the support arm, and their rotating joints.

[0019] In a further advantageous embodiment of the inventi, a computer tomography CT device has one patient positioning device on each side of the throughopening of the gantry. This makes it possible to perform CT examinations of a plurality of patients particularly smoothly and quickly.

[0020] That is, while one patient can be placed on the lowered patient bed on one side of the gantry, a patient located on the other patient positioning device can be examined in the CT device at the same time. Once the examination is concluded, the patient bed is lowered and thus moved away from the gantry. This makes the examination opening available for the examination of the next patient, who is moved toward the examination opening by the approaching motion of another patient positioning device. The patient bed of the patient to be examined can then be introduced into the bed guide, which has meanwhile become available, of the patient positioning device on the opposite side. The CT examination of that

patient then begin while the patient positioning device on the second side is lowered again for receiving the next patient.

[0021] Further advantages of the invention will become apparent from the drawings.

[0022] Exemplary embodiments of the invention will be described in further detail below in conjunction with the drawings. Shown are:

[0023] Fig. 1, a CT device with a patient positioning device, in perspective;

[0024] Fig. 2, the CT device with the patient positioning device, in a side view; and

[0025] Fig. 3, the CT device with the patient positioning device, in a side view.

[0026] In Fig. 1, a CT device 1 with a patient positioning device is shown in perspective. The CT device 1 has a gantry 3 with an examination opening. The gantry 3 rests on a base 5. A patient who is to be examined is placed on a patient bed 9, which is introduced into the bed guide 7. The bed guide 7 guides the patient bed 9 such a way that the patient bed is displaceable longitudinally, such that the patient bed 9 may be introduced into the examination opening in the gantry 3. In the drawing, a gantry 3 is shown with onemay have patient positioning device on each side of the examination opening, and it can be seen that the patient bed, on being introduced into the gantry, is introduced into the bed guide 7' of the opposite patient positioning device.

[0027] The bed guide 7 is supported rotatably in the arm 11 about a horizontal axis via a rotating joint 19. The arm 11 is in turn supported in or on the base 5 via a rotating joint 17 that is rotatable about a horizontal axis. The rotating joint 17 may be integrated with the base 5, or else,as part of the patient positioning device, and it maybe merely be mounted in the vicinity of the base 5 but not embodied as an integral part of it. As a result, the patient positioning device can be conceived of as a structural unit that is independent of the CT device 1 and that may be joined to it in modular fashion.

[0028] To adjust the height of the bed guide 7, the arm 11 is rotated about its rotating joint 17. In the process, to maintain the bed 9 orientation, which in the drawing is horizontal, the bed guide 7is likewise rotatable about the corresponding rotating joint 19.

[0029] The orientation of the bed guide 7 is stabilized by means of a support arm 13. The support arm 13 supports the bed guide insuch a way that sagging because of the patient's weight is prevented. To enable maintaining the orientation of the bed guide 7 while the height is being adjusted, the support arm 13 is supported in the arm 11 via a rotating joint 21 that is rotatable about a horizontal axis, and in the bed guide 7 via a rotating joint 23 that is likewise rotatable about a horizontal axis. The length of the supmay be adjusted mechanically by a gear-wheel or lever system that is driven by a rotary motion of the arm 11. On the other hand, the length adjustment may be effected hydraulically and may be adapted to the rotary motion of the arm 11 by means of a characteristic curve for controlling the hydraulic drive. The rotary motion of the arm 11 can be driven equally well either mechanically, for instance via a motor-driven worm gear and a gear wheel on the arm, or by a hydraulic drive.

[0030] As needed, the patient positioning device may be configured such that the bed guide 7 automatically always maintains a horizontal orientation, or such that the orientation of the bed guide 7 can be adjusted by the medical staff. Upon adjustment of the height by rotation of the arm 11, an orientation, once assumed, is automatically maintained by means of the mechanics or the hydraulics.

[0031] Of the further patient positioning device, located on an opposite side of the gantry, only the bed guide 7', is visible in the drawing. The other components, not visible, correspond to those that are shown visibly on a isside of the gantry 3.may have

In a further embodiment, the gantry 3 has a patient positioning device on only one side.

[0032] In Fig. 2 , the same CT device 1 with the patient positioning deviceon each side of the gantry 3, with a patient bed 9 introduced into only one of the two bed guides. It can be seen from this drawing that the t patient positioning device,

which in the preceding drawing was for the most part not visible, also has an arm 11', with rotating joints 17', 19' that are rotatable about horizontal axes, and a support arm 13, with rotating joints 21', 23' that are rotatable about horizontal axes.

[0033] A height adjuster 15 serves to adjust the height of the bed guide 7 by means of a rotary motion of the arm 11. To that end, it drives the rotary motion of the arm 11 by motor, either mechanically or hydraulically. The individual components of the height adjuster 15 are not shown in the drawing. What is visible in the drawing is that each of the two patient positioning devices has its own height adjuster 15, 15', which makes it possible to adjust the height of each of the two bed guides 7, 7' independently of one another.

[0034] In IFig. 3, a CT device 1 with one patient positioning device on each of the two sides of the gantry 3 is shown in a different embodiment, in a side view. The patient positioning devices have the similar characteristics to the patient positioning devices shown in Fig. 2, with the exception of the support arms 13, 13'. Support arms 13, 13', are rotatably attached to the height adjusters 15, 15', and to the bed guides 7, 7' by rotatable hinges 23, 23' and cooperate with the base 5, 5, and the bed guides 7, 7' to create a parallelogram structure with the arms 11, 11'. Such an arrangement assures the horizontal orientation of the bed guides 7, 7' during a height adjustment process. The arms 11, 11' are supported as described above and are driven by height adjusters 15, 15', the support arms 13, 13' are now located parallel to the arms 11, 11'. While one bearing point of the support arms 13, 13' is still located in bed guides 7, 7', the other bearing point is located in or on the base 5, to achieve a parallelogram arrangement.

[0035] The parallelogram arrangement mechanically maintains the orientation of the bed guides 7, 7' regardless of the motions of the arms 11, 11', To make a change in the orientation of the bed guides 7, 7', the support arms 13, 13', in this example, may be adjustable in length. The length adjustment can be effected mechanically or hydraulically.